33.7 $\Delta V_{\max} = 15.0\text{ V}$ and $R_{\text{total}} = 8.20\ \Omega + 10.4\ \Omega = 18.6\ \Omega$

$$I_{\max} = \frac{\Delta V_{\max}}{R_{\text{total}}} = \frac{15.0\text{ V}}{18.6\ \Omega} = 0.806\text{ A} = \sqrt{2}\, I_{\text{rms}}$$

$$\mathcal{P}_{\text{speaker}} = I_{\text{rms}}^2 R_{\text{speaker}} = \left(\frac{0.806\text{ A}}{\sqrt{2}}\right)^2 (10.4\ \Omega) = \boxed{3.38\text{ W}}$$

33.12 $\omega = 2\pi f = 2\pi(60.0/\text{s}) = 377\text{ rad/s}$

$$X_L = \omega L = (377/\text{s})(0.0200\text{ V}\cdot\text{s/A}) = 7.54\ \Omega$$

$$I_{\text{rms}} = \frac{\Delta V_{\text{rms}}}{X_L} = \frac{120\text{ V}}{7.54\ \Omega} = 15.9\text{ A}$$

$$I_{\max} = \sqrt{2}\, I_{\text{rms}} = \sqrt{2}\,(15.9\text{ A}) = 22.5\text{ A}$$

$$i(t) = I_{\max}\sin\omega t = (22.5\text{ A})\sin\left(\frac{2\pi(60.0)}{\text{s}}\cdot\frac{1\text{ s}}{180}\right) = (22.5\text{ A})\sin 120^\circ = 19.5\text{ A}$$

$$U = \tfrac{1}{2}Li^2 = \tfrac{1}{2}\left(0.0200\ \frac{\text{V}\cdot\text{s}}{\text{A}}\right)(19.5\text{ A})^2 = \boxed{3.80\text{ J}}$$

33.15 $$I_{\max} = \sqrt{2}\, I_{\text{rms}} = \frac{\sqrt{2}(\Delta V_{\text{rms}})}{X_C} = \sqrt{2}(\Delta V_{\text{rms}})2\pi f C$$

(a) $I_{\max} = \sqrt{2}\,(120\text{ V})2\pi(60.0/\text{s})(2.20\times10^{-6}\text{ C/V}) = \boxed{141\text{ mA}}$

(b) $I_{\max} = \sqrt{2}\,(240\text{ V})2\pi(50.0/\text{s})(2.20\times10^{-6}\text{ F}) = \boxed{235\text{ mA}}$

33.47 (a) $R = (4.50\times10^{-4}\ \Omega/\text{m})(6.44\times10^{5}\text{ m}) = 290\ \Omega$ and $I_{\text{rms}} = \dfrac{\mathcal{P}}{\Delta V_{\text{rms}}} = \dfrac{5.00\times10^{6}\text{ W}}{5.00\times10^{5}\text{ V}} = 10.0\text{ A}$

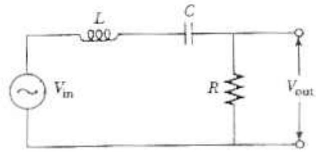
$$\mathcal{P}_{\text{loss}} = I_{\text{rms}}^2 R = (10.0\text{ A})^2(290\ \Omega) = \boxed{29.0\text{ kW}}$$

(b) $\dfrac{\mathcal{P}_{\text{loss}}}{\mathcal{P}} = \dfrac{2.90\times10^{4}}{5.00\times10^{6}} = \boxed{5.80\times10^{-3}}$

(c) It is impossible to transmit so much power at such low voltage. Maximum power transfer occurs when load resistance equals the line resistance of 290 Ω, and is

$$\frac{(4.50\times10^{3}\text{ V})^2}{2\cdot2(290\ \Omega)} = 17.5\text{ kW},$$ far below the required 5000 kW

*33.51 $\frac{\Delta V_{out}}{\Delta V_{in}} = \frac{R}{\sqrt{R^2 + (X_L - X_C)^2}}$



(a) At 200 Hz: $\frac{1}{4} = \frac{(8.00\ \Omega)^2}{(8.00\ \Omega)^2 + \left[400\pi L - \frac{1}{400\pi C}\right]^2}$

At 4000 Hz: $(8.00\ \Omega)^2 + \left[8000\pi L - \frac{1}{8000\pi C}\right]^2 = 4(8.00\ \Omega)^2$

At the low frequency, $X_L - X_C < 0$. This reduces to $400\pi L - \frac{1}{400\pi C} = -13.9\ \Omega$ [1]

For the high frequency half-voltage point, $8000\pi L - \frac{1}{8000\pi C} = +13.9\ \Omega$ [2]

Solving Equations (1) and (2) simultaneously gives $C = \boxed{54.6\ \mu\text{F}}$ and $L = \boxed{580\ \mu\text{H}}$

(b) When $X_L = X_C$, $\frac{\Delta V_{out}}{\Delta V_{in}} = \left(\frac{\Delta V_{out}}{\Delta V_{in}}\right)_{max} = \boxed{1.00}$

(c) $X_L = X_C$ requires $f_0 = \frac{1}{2\pi\sqrt{LC}} = \frac{1}{2\pi\sqrt{(5.80 \times 10^{-4}\ \text{H})(5.46 \times 10^{-5}\ \text{F})}} = \boxed{894\ \text{Hz}}$

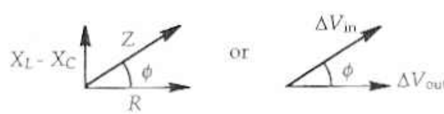
(d) At 200 Hz, $\frac{\Delta V_{out}}{\Delta V_{in}} = \frac{R}{Z} = \frac{1}{2}$ and $X_C > X_L$,

so the phasor diagram is as shown:

$\phi = -\cos^{-1}\left(\frac{R}{Z}\right) = -\cos^{-1}\left(\frac{1}{2}\right)$ so $\boxed{\Delta V_{out} \text{ leads } \Delta V_{in} \text{ by } 60.0°}$

At f_0, $X_L = X_C$ so $\boxed{\Delta V_{out} \text{ and } \Delta V_{in} \text{ have a phase difference of } 0°}$

At 4000 Hz, $\frac{\Delta V_{out}}{\Delta V_{in}} = \frac{R}{Z} = \frac{1}{2}$ and $X_L - X_C > 0$



Thus, $\phi = \cos^{-1}\left(\frac{1}{2}\right) = 60.0°$

or $\boxed{\Delta V_{out} \text{ lags } \Delta V_{in} \text{ by } 60.0°}$

(e) At 200 Hz and at 4 kHz, $\mathcal{P} = \frac{(\Delta V_{out,rms})^2}{R} = \frac{\left(\frac{1}{2}\Delta V_{in,rms}\right)^2}{R} = \frac{\frac{1}{2}\left(\frac{1}{2}\Delta V_{in,max}\right)^2}{R} = \frac{(10.0\ \text{V})^2}{8(8.00\ \Omega)} = \boxed{1.56\ \text{W}}$

At f_0, $\mathcal{P} = \frac{(\Delta V_{out,rms})^2}{R} = \frac{(\Delta V_{in,rms})^2}{R} = \frac{\frac{1}{2}(\Delta V_{in,max})^2}{R} = \frac{(10.0\ \text{V})^2}{2(8.00\ \Omega)} = \boxed{6.25\ \text{W}}$

(f) We take: $Q = \frac{\omega_0 L}{R} = \frac{2\pi f_0 L}{R} = \frac{2\pi(894\ \text{Hz})(5.80 \times 10^{-4}\ \text{H})}{8.00\ \Omega} = \boxed{0.408}$